Claims

What is claimed is:

1. A method for the automatic determination of the diameter of a round disk-like tool driven by a motor such as a saw blade for an automatic wall saw, comprising the following method steps:

(a) driving the tool with a motor torque M_{Mot} with a sinusoidal shape with amplitude $\hat{M}_{Mot}$ and with two defined measurement frequencies f_1 and f_2;

(b) measuring one of the amplitude $\hat{\omega}_R$ of the rotor speed ω_R of the motor and the amplitude of the gear unit torque $\hat{M}_G$;

(c) calculating the inertia Θ_S of the tool based on a mathematical model using variables $\hat{M}_{Mot}$, $\hat{\omega}_R$, f_1, f_2 and $\hat{M}_G$ and the previously determined inertia Θ_R of the tool drive; and

(d) determining the tool diameter from one of a given comparison table and comparison curve of a graph showing the relationship of tool inertia Θ_S to tool diameter.

2. The method of claim 1, further comprising the steps of:

(e) before the first method step (a), driving the tool at a constant exciting motor torque M_{Mot0} selected such that the tool rotates at a constant rotational speed ω_{RO},

(d) determining the tool friction d_S according to the equation:

$$d_S = \frac{M_{Mot0} - d_R \cdot w_{RO}}{\omega_{RO}},$$

where d_R is one of the known and previously determined friction in the drivetrain from the motor to the tool at motor speed ω_{RO}.

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3. The method of claim 1, further comprising the steps of:

(e) before the first method step (a), measuring the torque M_{G0} in the drivetrain from the motor to the tool, wherein the tool is driven at a constant motor torque M_{Mot} selected such that the tool rotates at a constant rotational speed ω_{RO};

(g) determining the tool friction according to the equation:

$$d_S = d_R \cdot \frac{M_{G0}}{M_{Mot} - M_{G0}},$$

where d_R is one of the known and previously determined friction in the drivetrain from the motor to the tool at rotational speed ω_{RO}.

4. The method of claim 2, wherein step (c) further comprises the step of calculating the tool inertia Θ_S by the equation

$$\Theta_S = \frac{-2\pi f_{Meas}\Theta_R\hat{\omega}_R \pm \sqrt{-d_R{}^2\hat{\omega}_R^2 - 2d_R d_S\hat{\omega}_R{}^2 - d_S{}^2\hat{\omega}_R{}^2 + \hat{M}_{Mot}{}^2}}{2\pi f_{Meas}}.$$

5. The method of claim 1, further comprising the step of selecting the measurement frequencies f_{Meas} within a frequency range located appreciably above a limit frequency f_e defined by the friction and the inertia of the total system and appreciably below the resonant frequency f_{res} of the total system, i.e., $f_e \ll f_{Meas} \ll f_{res}$, and wherein step (c) further comprises the step of calculating the tool inertia by the equation

$$\Theta_S = \frac{\hat{M}_{Mot}}{\hat{\omega}_R}\frac{1}{2\pi f_{Meas}} - \Theta_R.$$

6. The method of claim 5, comprising the step of determining the limit frequency by the equation

$$f_e = \frac{1}{2\pi} \frac{d_R + d_S}{\Theta_R + \Theta_S}.$$

7. The method of claim 2, comprising the step of carrying out the determination of the tool friction d_S multiple times with different values of the exciting motor torque M_{Mot0} to increase accuracy, and averaging the obtained values.

8. A method for the automatic determination of the diameter of a round disk-shaped tool driven by a motor such as a saw blade for an automatic wall saw, comprising the steps of:

(a) accelerating the tool with a defined, constant torque M_{Mot};

(b) recording the curve $\omega(t)$ of the rotational speed over time;

(c) determining an end value $\bar{\omega}_{end}$ of the rotational speed corresponding to the torque M_{Mot} and calculating the coefficient of friction

$$d_{tot.} = \frac{M_{Mot}}{\bar{\omega}_{end}},$$

(d) determining the time τ period from the start of the motor acceleration until reaching the $(1 - e^{-1})$ fraction of the end value of the rotational speed $\bar{\omega}_{end}$;

(e) determining the inertia of the tool according to the equation

$$\Theta_S = \tau \cdot d_{tot} \cdot \Theta_R,$$

where Θ_R designates one of the known and previously determined inertia of the rotor of the drive motor including the gear unit; and

(f) determining the tool diameter from one of a given comparison table and comparison curve of the relationship of the tool inertia Θ_S to the tool diameter.

9. The method of claim 8, comprising the step of recording the rotational speed curve over time in memory in increments $\omega_n = w(t_n)$; $n = 0, 1, 2, 3, \ldots$

10. A method for the automatic determination of the diameter of a round disk-shaped tool driven by a motor such as a saw blade for an automatic wall saw, comprising the steps of:

(a) accelerating the tool with a defined, constant torque M_{Mot};

(b) recording the curve $\omega(t_n)$ of the rotational speed over time in small time increments until a constant rotational speed ω_{end} is reached;

(c) calculating a coefficient of friction with the equation:

$$\bar{d}_{tot} = \frac{M_{Mot}}{\bar{\omega}_{end}},$$

where $\bar{\omega}_{end}$ corresponds to the average rotational speed for the last data points of the recording of the rotational speed curve, where

$$\bar{\omega}_{end} = \frac{1}{(n_{end} - n_0)} \sum_{k=n_0}^{n_{end}} \omega_k,$$ where $n = n_0, n_1, \ldots, n_{end}$ for $t > t_{n0}$ and $\omega_n = \omega_{end}$;

(d) determining the time constant $\bar{\tau}$ of the slope of the rotational speed curve for the data points before the last data points used for determining the coefficient of friction $\bar{d}_{tot}$;

(e) calculating the inertia of the tool by the following formula:

$$\Theta_S = \overline{\tau} \cdot \overline{d}_{tot} \cdot \Theta_R,$$

where Θ_R designates one of the known and previously determined inertia of one of the rotor and the drive motor including the gear unit; and

(f) determining the tool diameter from one of a given comparison table and comparison curve of the relationship of tool inertia Θ_S to tool diameter.

11. A device for a wall saw for determining the saw blade diameter wherein:

(a) the tool is driven with a motor torque M_{Mot} with a sinusoidal shape with amplitude $\hat{M}_{Mot}$ and with two defined measurement frequencies f_1 and f_2;

(b) the amplitude $\hat{\omega}_R$ of the rotor speed ω_R of the motor is measured or the amplitude of the gear unit torque $\hat{M}_G$ is measured;

(c) the inertia Θ_S of the tool is calculated based on a mathematical model using variables $\hat{M}_{Mot}$, $\hat{\omega}_R$, f_1, f_2 and $\hat{M}_G$ and the known or previously determined inertia Θ_R of the tool drive; and

(d) the tool diameter is determined from one of a given comparison table and a comparison curve of a graph showing the relationship of tool inertia Θ_S to tool diameter.